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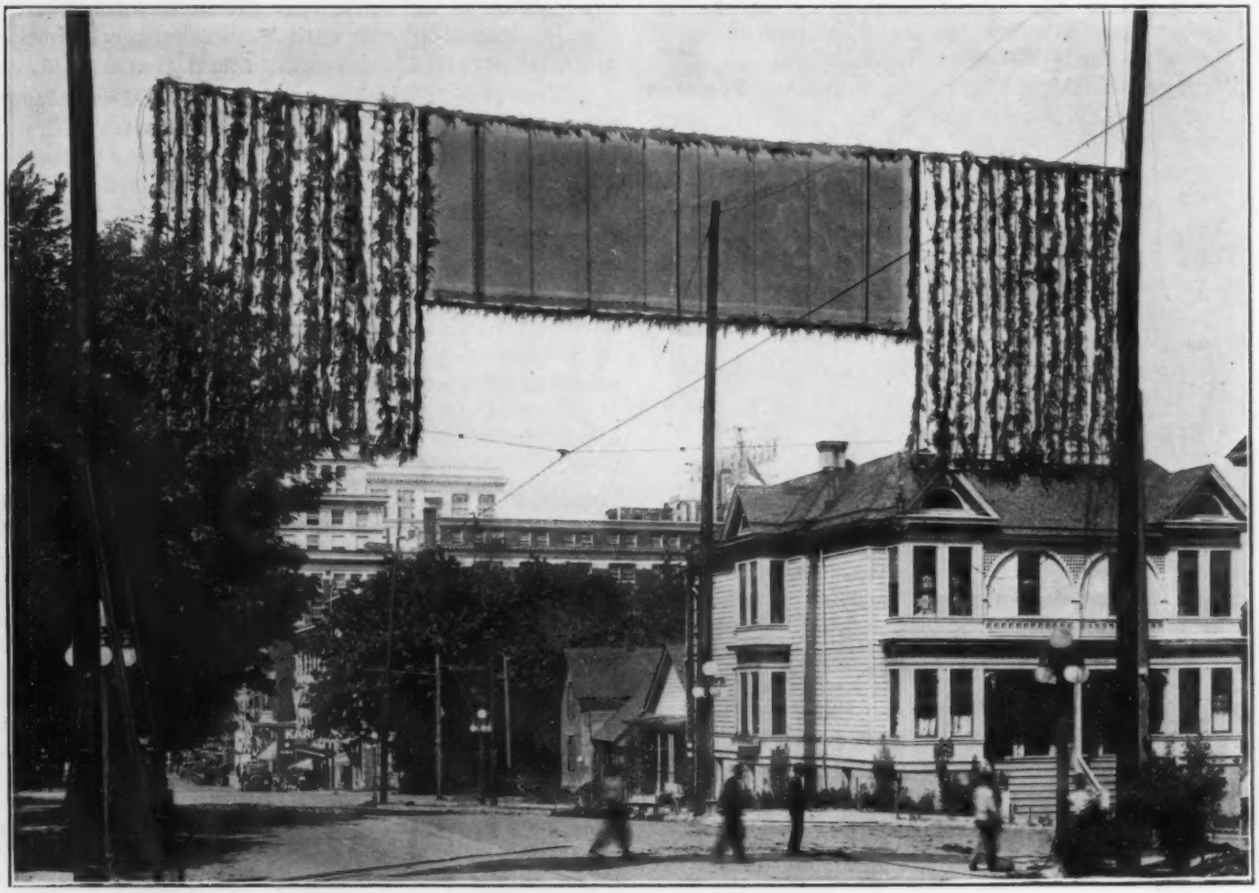
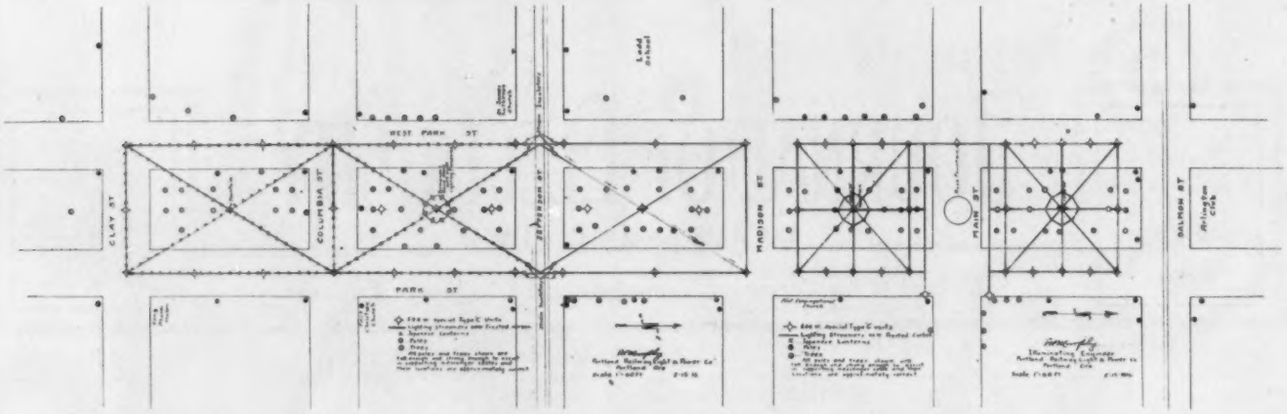
ELECTRICAL FEATURES OF PORTLAND ROSE FESTIVAL

BY F. D. WEBER.

Every year the question arises how to create new electrical features for the annual rose festival held at Portland, Oregon. This would not be so difficult if the funds were unlimited and the festival was not an annual affair. Consequently, it is interesting to note what was accomplished this year at a moderate expense. The work was done under the direction and supervision of O. B. Coldwell, Rose Festival director, with the assistance of F. H. Murphy, illuminating engineer, with the Portland Railway, Light & Power Company. Commencing at Broadway and Washington streets two large columns were erected 30 ft. in height. These columns were illuminated by flood lighting and featured paintings presenting the scenic wonders of Oregon. In a niche in each column was a statue of Sacajawea pointing the way to the festival center. Two more columns were erected on Main street between Broadway and Park streets. These columns also showed paintings of Oregon scenery, and in the niches of the figures gave a reproduction of the "Coming of the White Man." This was intended to emphasize the amazement of the Indian



Day Picture of Rose Curtain.



Map of Decorated Section.

at what the white man has accomplished since he first came to the Oregon country.

Between Washington and Main streets, on Broadway, there was a series of chandeliers and canopies at Alder, Morrison, Yamhill, Taylor and Salmon streets. These chandeliers featured cupids and bluebirds suspended in midair from circular frames, the figures swinging with the wind. Each cupid held a flashing torch and jewels sparkled from branches carried in the mouths of the birds. Festoons of jewels were carried about the chandeliers, giving an effect similar to the flashing of precious stones as presented at the Palace of Jewels at the P. P. I. E. The canopies presented a myriad of colored lights forming a perfect dome. Cedar festoons were used about the canopy to cover the framework.

The two columns at Main street served as a frame for the rose fountain in the distance, which was the central floral display of the center. Two electrical curtains served to mark the entrance to the center. One curtain closed off Main street at Broadway and was composed of hundreds of lights and cedar festoons.

Another curtain at Main street built along similar lines, hung across Broadway east to west and featured a mammoth pink rose. In the day time the rose was not visible, but at night flood lights were used to produce the effect of a rose flower blooming in a most artistic and striking manner.

From Salmon street to Jefferson street the illumination of the floral display was such as to bring out the flowers in their true colors. Great curtains of frosted white lights produced this effect. From Jefferson to Clay streets streamers of colored lights and the use of Japanese lanterns served to transform this section of the center into a veritable fairyland. Here the band concerts, dancing and other entertainment features were held.

In addition to the columns, canopies and chandeliers along Broadway electrical streamers completed the picture.

The cluster lights along Broadway fitted into the plan of decoration and colored lights were flashed from the globes.

The decorations were extended along North Sixth street to the depot, making a white way clear to the festival center. Also flag decorations and garlands of evergreens were used in all of the principal streets. These garlands ran the entire length of the blocks and were caught up at 20 points in each block with a big hanging basket of bright flowers.

Individual property owners in the business section co-operated with the festival management in working out the general decorations and through this co-operation a broad unity in the decoration scheme was achieved.

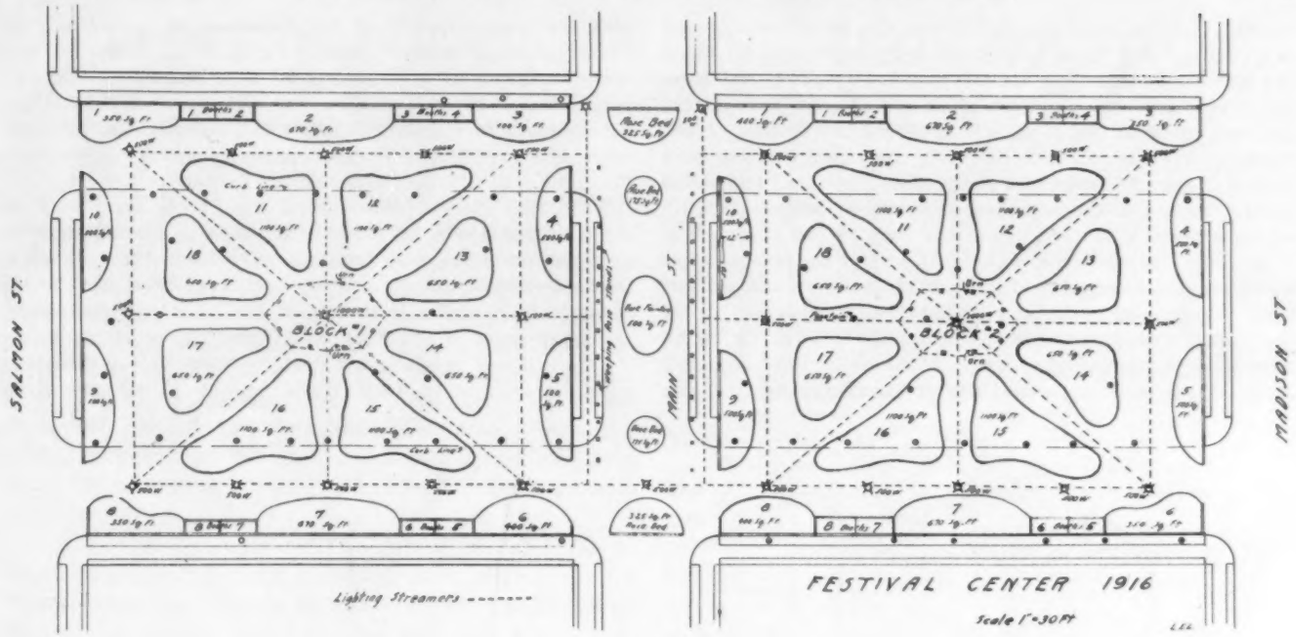
The bridges across the Willamette River were illuminated as were also two warships in the river.

In decorating the park blocks between Madison and Clay streets the following material was used:

Two type "C" lighting units with 1000 watt lamps, twenty-seven type "C" lighting units with 500 watt lamps, approximately 3700 ft. of lighting streamers with lamps. Approximately two hundred Japanese lanterns. The necessary messenger cables to support the lighting streamers and type "C" lighting units properly. The feeders for connecting from the transformers to the lighting system. Transformers were located on poles at convenient places for attachment of the feeder system. The arrangement is shown by accompanying cuts which are self explanatory.

The electrical installation in the festival center blocks, included between Salmon and Madison streets, were handled under a separate contract and provided feeders, overhead streamers, special lighting units, and wiring of the floral booths as shown in accompanying cut. The specifications for the rose fountain were as follows:

"The rose fountain is composed of a fountain head from which the water issues, a shaft or tower down which the water flows, a basin which receives the water and a basin rim which retains the water, within the basin. It is primarily intended to represent a fountain of roses bubbling over in a foaming spray at the top and falling in sparkling sheets into the basin at the foot of the fountain, where it splashes and swirls about in numerous eddies. Trailing rose vines and rose blooms will carry out this effect, but the movement, sparkle and foam must be produced by electric lights in connection with a suitable flasher. The contractor must keep in mind, during his estimating (and if the successful bidder, during his construction work), the fact that roses are the primary feature of the fountain and the electric lights are only the secondary feature. While the electrical features are equally as important in the success of the fountain as the floral features, yet they must be carried out in such a way that the movement and sparkle will appear to be that of the roses themselves. In fact, this feature is of so much importance that unless the committee can assure themselves that the



Map of Festival Center.

bidder is capable of and will make every effort toward carrying out their desires in these respects as just explained, it will be necessary for them to refuse to consider the bid. In other words, the bidder on this portion of the work must furnish ample evidence of his ability to successfully perform the work in case the contract shall be awarded to him.

"The fountain head shall consist of the top part of the fountain, approximately five feet in height, from which the water apparently issues and passes down over the sides of the tower or body. It is to be constructed as a separate piece and in such a manner that it may be set upon and securely attached to the top of the tower frame. It is to consist of electric lights not over six inches apart arranged in strips in such a manner as to form a central jet with two or three spurts of light higher than the main jet and a little lower than the rounded head of the fountain, representing the main body of water boiling over and falling down the sides of the fountain. The strips of lamps forming this head are to droop far enough to mingle freely with the strips forming the fountain tower or body. Great care must be taken to make the supports of these lighting strips as inconspicuous as possible. A coat of neutral paint will assist materially in this respect and must be used.

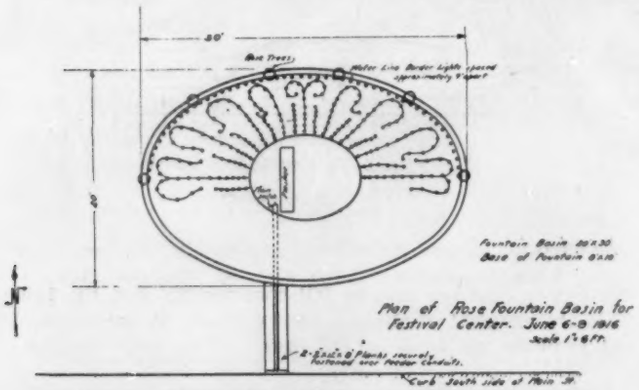
"The fountain tower is to be 30 ft. high. The frame work will be approximately three feet in diameter at the top and at the bottom will form an oval 8 ft. by 10 ft. This frame work will be constructed by the festival center committee and will be ready for the contractor in ample time to permit him to fulfill the requirements called for in this specification. The frame will support the shelves on which will be placed the pots containing the trailing rose vines that are to form the rose fountain. The strips of lamps which are to carry out the effect of the water falling down the sides of the tower may be attached to this framework and allowed to fall downward and outward as shown in the cross-section of the tower in one of the cuts accompanying this article. The rose vines are to fall over the outside of the lighting strips and partially conceal them. The strips supporting the lamps must be painted green of a shade to match the rose leaves. The shade to be used must meet the approval of the engineer, and the contractor must secure this approval before painting the strips. Sixteen of these lighting strips are to fall continuously from the top of the tower into the basin, and approximately 12 ft. above the ground up the sides of the tower, sixteen other strips arranged alternately with the longer ones are also to fall continuously into the basin. This arrangement of strips is shown clearly in the developed cut showing the sides of the tower. The lamp spacing of

Day Picture of Electrical Rose Fountain.

these strips will be approximately nine inches except for the two top lamps on each of the short strips, in which case the spacing will be approximately twelve inches.

"The fountain basin is elliptical in form, 20 ft. by 30 ft. outside of the rim, the long diameter, as also that of the fountain tower, coinciding with the longitudinal center line of the

street. It is to consist of two parts, the inner part around the base of the tower and about 4 ft. in width in which the water rebounds from its fall and flows radially out from the tower, and the outer part lying immediately beyond this and extending to the basin rim in which the surface of the water smooths out, flows to the basin rim where it is returned toward the center in seaisles and eddies. The thirty-two strips falling down the lower part of the tower continue radially outward from it to form the inner part of the basin. The crest of the first rebound of water is about four and one-half feet above the street surface and of the third, about two and one-half feet. The spacing of the lamps in the strips forming this part of the basin is approximately nine inches. The short strips terminate at the outer line of this part of the basin, but the longer strips which come from the top of the tower continue on


Fountain Basin
Base of Fountain Basin
Plan of Rose Fountain Basin for Festival Center. June 6-9 1916
Curb South side of Main St.

Plan of Rose Fountain Base.

radially to the rim of the basin where they bend backward in graceful curves toward the center, forming the outer part of the basin which contains the eddies to which reference has been made previously. The average height of this part of the basin is about two feet above the street surface and the spacing of lamps is approximately twelve inches. Rose vines are to cover the lamps and wiring in the basin the same as on the sides of the tower, and the supporting strips are to be painted in the same shade of green as those on the tower. Two cuts, one a cross-section and the other a plan, illustrate this paragraph.

"The rim of the basin or fountain will be raised about six inches above the basin level and on the inside of this rim facing the fountain, a row of lights is to be arranged in a wavy line, the lights varying from two to two and one-half feet above the street surface. These lights are to represent the disturbed water line of the basin and are to be operated in the form of a slow chaser. The lamp spacing will be approximately nine inches.

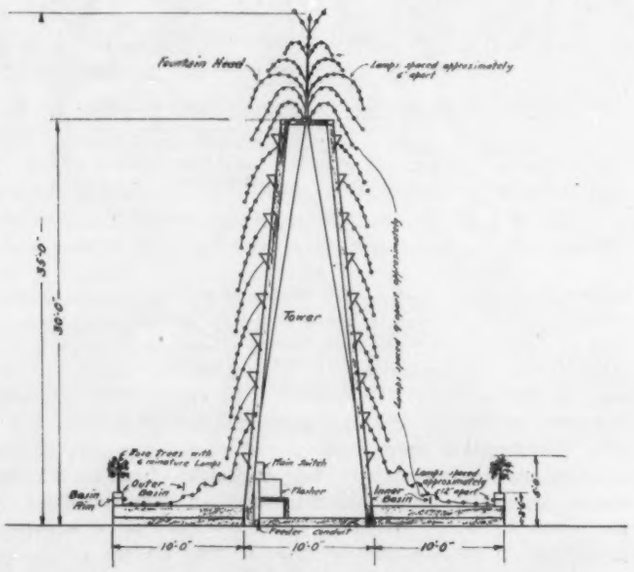
"At regular intervals about the rim of the basin ten rose trees are located. The tops of these trees will be about five feet above the street surface. Each tree is to have six miniature lamps distributed about in the foliage. The cords supplying these lamps must be dark green. The lamps must be connected in multiple and may be battery lamps connected directly to battery transformers which in turn are connected to the lighting circuit.

"Main street between Park street and West Park street will form the rose promenade, in the center of which will be the rose fountain. Along the curb on either side of the promenade will be a border of weeping rose standards, fourteen on either side. Each rose standard is to have a cluster of six miniature lamps draped about in the foliage. The lamps may be battery lamps and must be connected in multiple in each string or cluster. The cord must be dark green. Battery or low voltage transformers are to be used with these lamps, the transformers to be connected to the lighting service.

"The flasher must be of a high speed type with not less than sixteen brushes, each brush to have a continuous full load operating capacity of not less than 10 amperes. The flasher must be positive and reliable in its operation, and must be driven by a single-phase, 60 cycle, alternating current motor of not less than ⅛ h.p. The speed of the flashing effects must be tested and approval obtained from the engineer before permanent connections are made. (The Reynolds Flasher Co. of Chicago furnished the flasher for the job).

"Pigtail sockets or standard sign receptacles may be used. These are to be securely attached to flexible supports of wood or metal, and arranged as described elsewhere in these specifications. In any case, all receptacles used in the fountain head at the basin rim, as described in these specifications must be of the same type thoughout.

"All lamps used in the rose fountain unless otherwise specified must be 10 watt, frosted, carbon, sign lamps of ap-



Cross Section of Fountain.

proximate 115 volts, and connected in multiple for all operations. Approximately 1700 lamps will be required for the fountain, distributed about as follows: Fountain head, 350; fountain tower, 900; basin, 350; basin rim, 100."

The electrical decorations and features at the festival center were installed under contract by the E. L. Knight Electric Company and the M. J. Walsh Electric Company. The electric fountain was erected and installed by A. H. Hallam. The special decorations in the streets were erected and installed by Pierre L. Traglio.

A method of numbering canals and turnouts is essential on large systems. Such numbers are needed for reference in the records which may be kept and serve as abbreviated names in the field notes of gage heights, etc. The number of a turnout should in some way indicate its location. This may be done by having the number equal the distance in miles and tenths of the turnout from the head of the canal from which it takes. Another system is to alternate letters and numbers. The main laterals are given letters, the laterals from these numbered in order from the upper end of the main laterals, and so on. The third lateral taking out from the fourth lateral on the A main would be A-4-C. When all laterals and sublaterals are built before numbering, this system is satisfactory. Where other intermediate sublaterals may be built, it is confusing.

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

SEASONAL USE OF WATER IN THE SACRAMENTO AND SAN JOAQUIN VALLEYS.

The run-off of the streams of the Sacramento and San Joaquin Valleys of California decreases during July, so that without storage many canal systems have difficulty in securing the amounts of water required during the later part of the season. This is particularly true on those streams where the development is relatively large in proportion to the stream flow. On some systems storage works have been constructed; on others, plans for their use have been made, actual construction being delayed until the area irrigated increases beyond the capacity of the normal low flow.

For many systems the seasonal distribution of water, or seasonal duty, depends more largely on the water available than on actual crop needs. Systems where the late summer flow is deficient may either attempt to raise the water table by excessive use during the early summer—a form of ground storage,—so that crops may be supplied from this source, or the crops may be adapted to the character of the water supply. Systems having a late season water supply available or individuals securing their water by pumping are more independent in their choice of crops and time of application.

In attempting to find out the need for late season water, two methods of comparison may be used. The seasonal use of gravity systems having available full seasonal supplies may be compared with those where the late supply is deficient, or the difference in yield due to different practice in irrigation may be compared to give an indication of the crop value of late irrigation. The following discussion includes comparisons of both of these two types. They were mainly prepared from the records of use and of experiments which are published in Bulletin No. 1 of the California Department of Engineering.

In Fig. 1 and Table 1, the seasonal use of different canal systems is given. These are expressed in the percentage of the total annual diversions which occur in each month. Of the four years for which records are shown, two (1912 and 1913) were years of less than normal rainfall and of late season water supply, and two (1914 and 1915) were years of more than normal precipitation. In 1915, the spring was unusually late and wet, use in the earlier season months being much less than normal.

On the Orland project the storage was not fully developed in 1912 and 1913, and the use, after early

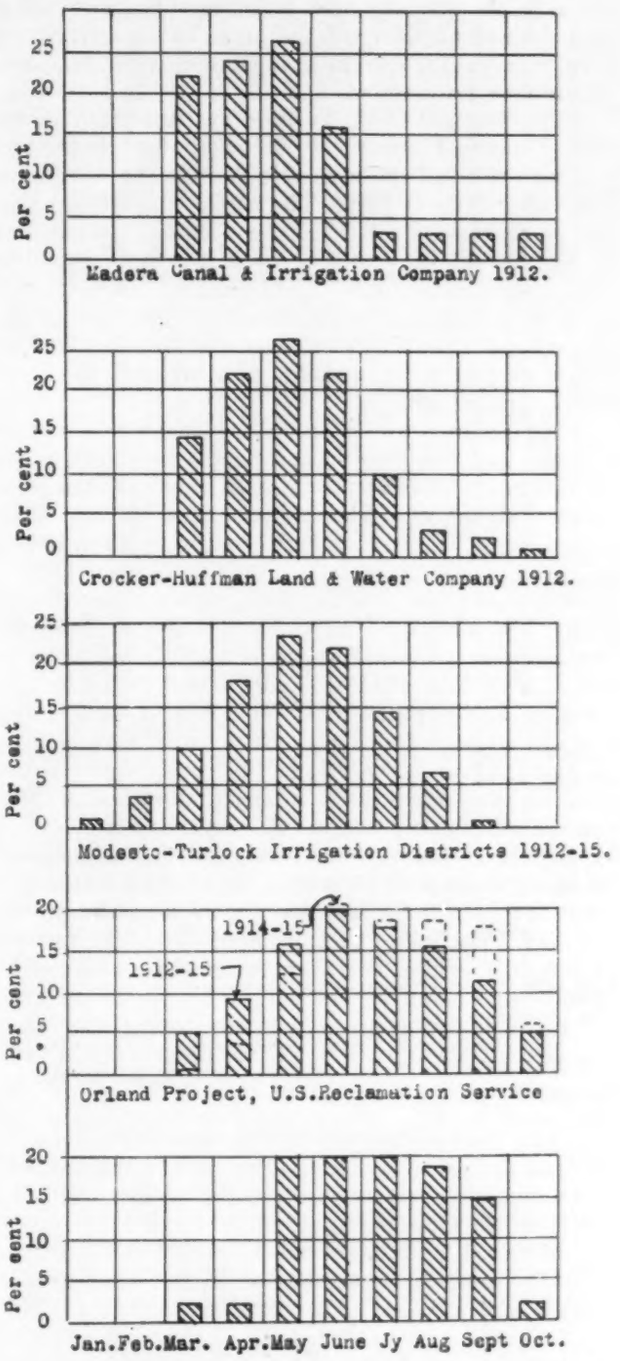

Per cent
Madera Canal & Irrigation Company 1912.
Crocker-Huffman Land & Water Company 1912.
Modesto-Turlock Irrigation Districts 1912-15.
1914-15
1912-15
Orland Project, U.S.Reclamation Service
Jan. Feb. Mar. Apr. May June Jy Aug Sept Oct.
Average of 61 individual fields Sacramento Valley, 1913-14.

Fig. 1. Per Cent of Total Seasonal Supply Used in Each Month by Different Systems.

Table I.—Per Cent of Total Seasonal Supply Used in Each Month by Different Systems.

Canal.	Year.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Madera Canal and Irrigation Company	1912	..	..	22	24	26	16	3	3	3	3	..	..
Crocker-Huffman L. & W. Co	1912	..	..	14	22	26	22	10	3	2	1	..	..
San Joaquin & Kings River Canal	1912	5	5	11	15	18	19	17	7	3	..	..	..
Modesto Irrigation District	1912	..	4	13	20	27	21	14	1	..	..	..	..
Modesto Irrigation District	1913	7	6	9	21	21	21	11	3	1	..	..	..
Modesto Irrigation District	1914	4	8	12	11	17	19	17	11	1	..	..	..
Modesto Irrigation District	1915	..	2	15	16	20	22	20	4	1	..	..	..
Turlock Irrigation District	1912	..	4	13	16	24	25	16	2	..	..	..	..
Turlock Irrigation District	1913	..	7	10	19	23	22	13	6	..	..	..	..
Turlock Irrigation District	1914	..	..	7	24	34	26	0	6	3	..	..	..
Turlock Irrigation District	1915	..	..	2	14	14	21	21	24	4	..	..	..
Mean Modesto-Turlock	....	1	4	10	18	23	22	14	7	1	..	..	..
Orland Project	1912	..	..	3	11	19	19	17	15	8	8	..	..
Orland Project	1913	..	..	16	19	22	17	17	9	..	..	..	..
Orland Project	1914	..	..	2	7	18	18	16	18	16	5	..	..
Orland Project	1915	..	..	..	..	6	24	22	20	20	8	..	..
Orland Project	Mean	..	..	5	9	16	20	18	16	11	5	..	..
61 Individual Fields	1913-14	..	..	2	2	20	20	20	19	15	2	..	..

in August, particularly in 1913, represents less than would have been used could additional water have been secured. In 1914 and 1915 sufficient water was available so that the use represents practice under conditions of ample water supply. The increased use after July in 1914-15 in comparison with 1912 and 1913 is very noticeable.

The Modesto and Turlock systems both divert from Tuolumne River. It is usual for these two canals to take all the available flow in the Tuolumne River after early in July. The use in August and September represents what can be secured, rather than the amount which would be used if a more complete supply were available. The figures for the different years vary, due to the difference in character of the season, and run-off. The zero use by the Turlock system in July, 1914, was due to a break in the canal during that month.

The records for 1912 on the Madera, Crocker-Huffman and San Joaquin and King's River canals are representative of the water supply of the stream from which they divert. The Madera canal diverts from Fresno River, whose flow is derived from lower drainage areas of light snowfall. The supply after June is uncertain and the use in these months necessarily small. The Crocker-Huffman canal diverts from the Merced River. The difference in the July use between this canal and the Modesto and Turlock canals in 1912 is due to the difference in available flow in the streams. The San Joaquin and King's River canal diverts from the San Joaquin River, and in 1912 was able to secure a greater proportion of its supply in July and August than the other San Joaquin Valley systems cited.

In the Bulletin 1 previously cited, the seasonal use of water on a large number of alfalfa fields in different parts of the Sacramento Valley is given for 1913 and 1914. Excluding those around Woodland, where the use is irregular, the average for the remaining 61 fields is also given in Table 1. This shows an even larger use of water in August and September than that on the Orland project. These fields were in locations where late season water could generally be secured.

These various records are for systems on which alfalfa is the principal crop. The lands are similar in season and other factors affecting the time of use. The results on the Orland project in 1914 and 1915 and on the individual fields show an average use in August of 19 per cent, in September of 16 per cent, and in October of 4 per cent of the total season's use. This may be taken as representative of the proportion of the total amount which will be used if available during these months. It would appear that systems having a large proportion of their area in alfalfa will use one-third of the total season's supply after August 1. This cannot be done at present on streams extensively developed unless storage is available. The need of this later season use is becoming felt on several systems, and plans for storage are under way. The ability to secure such water for irrigation throughout the season is also one of the advantages of supplies pumped from wells. It may not be desirable to provide one-third of the total supply after August 1, but some amount greater than the average of 8 per cent secured by the Modesto and Turlock systems is needed. In many years, systems depending on direct flow also find difficulty in securing a full supply in July.

The expense which will be warranted for storage or other means of securing an adequate water supply for the later season depends on the increase in yield which can be secured for its use. Such increase can be most easily measured for alfalfa, due to the number of crops secured during the season. The value of such water supplies may be greater for other crops which may need late irrigation.

The later cuttings of alfalfa are usually of less weight than those secured earlier in the season, so that a late summer irrigation on this crop will not add as much to the yield of the crop as one applied in the early summer. Late summer irrigation is not required for grain. It is not usual, however, to irrigate much grain in this section of California. Land from which grain has been harvested may, however, be irrigated and a crop of Egyptian corn secured in the same year if a water supply is available. For deciduous fruits the time of irrigation varies with the variety of fruit. Irrigation after picking is practiced in some localities for some early season fruits, such as apricots. Except where supplied by sub-irrigation, later seasonal use of water is usually needed for deciduous fruits.

It is difficult to measure the additional yield produced by late irrigation for any crop except alfalfa. The yield of fruit depends on many other factors besides irrigation and the practice of one year may affect the following year's crop. In connection with experiments on the duty of water for alfalfa on the University Farm at Davis, different amounts and times of application were tried on different plats from 1910 to 1914. From these results the following data are taken, being rearranged from the tables published in Bulletin 1 of the California Department of Engineering and Bulletin 10 of the U. S. Department of Agriculture. The comparisons as to returns were based on an estimated labor cost of production of $2.25 per ton. The cost of water was taken at $1.70 per acre foot, the cost at Davis, and the labor cost of applying water at 50 cents per acre per irrigation. The value of hay in the stack for the five years varied from $4 to $10 per ton averaging $7.28 per ton.

Table 2.—Comparisons of Water Used, Yield and Returns in Alfalfa Experiments, Davis, Cal., 1910-14.

Total Depth of Water Applied per Season in Inches.	Schedule of Irrigations in Reference to Cuttings	Yield in tons per Acre	Total Value of Crop per Acre	Increase in Yield Over that Secured with		Increase in Net Returns Per Acre Over That Secured with		Increase in Returns per Acre Foot of Water Used Over that Secured with	
				Two 6 in. Irrigations Tons per Ac.	Three 6 in. Irrigations Tons per Ac.	Two 6 in. Irrigations.	Three 6 in. Irrigations.	Two Irriga. tions.	Three Irrigations.
0	.....	4.42	$32.41	....	....	.....	....	....	....
12	6 in. after 1st and 2d.....	5.90	42.63	....	....	.....	....	....	....
18	6 in. after 1st, 2d and 3d.....	7.04	51.29	1.14	....	$ 5.58	....	$11.16	....
24	6 in. after 1st, 2d, 3d and 4th.....	7.81	55.81	1.89	.77	7.90	$2.32	7.90	$4.64
30	7½ in. after 1st, 2d, 3d and 4th.....	9.12	65.75	3.22	2.08	14.87	9.29	9.91	9.29
36	9 in. after 1st, 2d, 3d and 4th.....	9.40	66.98	3.50	2.36	15.47	9.89	7.74	6.60
48	12 in. after 1st, 2d, 3d and 4th.....	9.43	68.20	3.53	2.39	16.62	11.04	5.54	4.42
60	12 in. after 1st, 2d, 3d 4th and 5th..	9.19	67.57	3.29	2.15	16.03	10.45	4.01	2.98

These experiments were conducted on a dark-brown loam of good water-holding capacity. Ground water averaged 14 ft. below the surface. The average yield obtained with no irrigation, 4.4 tons, indicates favorable conditions for growth without irrigation.

Different schedules of irrigation were used. The plats on which 1, 2, 3, or 4 irrigations of 6 inches' depth each were used give the best comparisons as to the effect of late season water. The other schedules on which greater depths of single irrigation were used are not as directly comparable.

The comparisons show that where an irrigation was applied after the third cutting it increased the yield ¾ of a ton over that on those plats receiving only two irrigations. Deducting the cost of irrigation and handling this increase in yield, an additional return of $5.58 per acre per year was secured. Where a fourth irrigation was given, the increased return over two irrigations was $7.90 per acre and over three irrigations $2.32 per acre. As six-inch depths of irrigation were used, this amounts to an increased return for each acre-foot used on the land of $11.16 where three irrigations are compared with two irrigations, and of $4.64 where four irrigations are compared with three. It should be remembered that these numerical comparisons are for the conditions at Davis. Where the water table is raised by early irrigation, late irrigations may be of less benefit. Where the soils are porous without ground water within reach of the crop, the yields secured without irrigation or with only two irrigations would be correspondingly less and the benefits from late irrigations correspondingly greater. For heavy soils more frequent irrigations are often necessary, due to the small amount of water which is absorbed by the soil at each irrigation.

Other crops were included in these experiments. The grain irrigation was completed in May. In one experiment with Egyptian corn, three irrigations, one each in June, July, and August, gave an increase in yield of 1275 pounds per acre over that secured from one irrigation in June and an increase of 315 pounds over that secured from two irrigations, one each in June and in July. In two experiments with sugar beets, two irrigations gave greater yields than one irrigation, and in one experiment these irrigations gave an increase in yield of 3.85 tons over two irrigations. The irrigation of the beets, however, was completed by the middle of July and could have been supplied by most gravity systems without storage.

These comparisons of seasonal duty and yield under varying irrigation practice give some indication of the need and value of irrigation after July in these valleys. The present seasonal use of water is determined for many systems by the nature of the water supply and the crops and their irrigation practice adapted to the nature of the water supply. If late season water can be secured either by pumping from ground water or by storage, the choice of crops need not be limited by the seasonal supply available. As development becomes greater in proportion to the normal flow of the different streams storage will become more necessary, and increased use of stored water is to be expected.

PROSPECTIVE POWER MARKET FOR IRRIGATION PUMPING IN OREGON AND WASHINGTON.

BY JOSEPH JACOBS.

Discussion of Projects.

I shall herein discuss only, and in briefest terms, certain features of those projects which it seems to me specially call for consideration beyond the information and data given in Fig. 40 for all the projects. I shall also discuss briefly some of those areas and projects which for various reasons were not regarded as probable users of Celilo power.

Castle Rock Slope.—This is the largest and most important irrigation pumping project in Oregon, embracing a possible irrigable area of 150,000 acres, the general boundaries of which may be defined as follows: On the west it is bounded by Willow Creek, on the north by the Columbia River and by the southerly limit of the West Umatilla Project, on the east by the Umatilla River, Hunt's Canal and Butter Creek, and on the south by the higher lands, for which pumpage is not regarded as feasible.

Its soils may generally be described as being a volcanic sandy loam of a general depth of from one to ten feet. Along the Columbia River and at westerly end of project a strip two miles wide by ten miles long may be classed as "scab land," i.e. lands with rock exposed at its surface, and practically all of this area has been eliminated as non-irrigable. The soil is by no means uniform over the project, volcanic loam prevailing in the westerly half of project, while the easterly half ranges from sandy loam to gravelly loam, the more gravelly portion being at the extreme easterly end of the project.

The district contains excellent lands to an elevation of at least 750 ft., but it is not deemed feasible to reach this elevation, and the elevation of the highest land considered is only 685 ft., which however, means an actual pumpage head, including friction losses, of 457 ft. and a mean pumpage head of 381 ft. An auxiliary pumping scheme has also been considered which contemplates a maximum lift of only 310 ft. The gross area included in the larger project is 172,000 acres, of which 150,000 acres are classed as irrigable, and in the smaller project 62,000 acres, of which 50,000 acres are classed as irrigable.

A possibility for storage exists on this project, this being in the so-called Carty reservoir site, with dam site located in section 33, township, 3 north, range 24 east. It appears that with an earth dam 55 ft. high, about 30,000 acre feet of effective storage might be secured at a cost of about $6 per acre foot. The utilization of such storage would permit a certain amount of winter pumpage which might operate to slightly reduce the total per acre cost of project, though this is by no means certain, nor have sufficient borings been made to definitely establish the water tightness and general merit of the reservoir. For these reasons and for the reasons mentioned in a previous paragraph concerning storage no allowance was made for storage in estimating project costs.

The project costs have been worked out on a basis of installing concrete pump houses equipped with high grade machinery throughout and of main canals and distribution system down to carrying capacities

of 5 s.f. being lined with concrete except where fluming or piping may be necessary. The cost estimates, omitting details, were as follows:

Item.	150,000 acre Project.	50,000 acre Project.
Main pumping station	$1,332,000	$ 443,000
First auxiliary pumping station	76,000	
Second auxiliary pumping station	366,000	
Pressure mains	1,500,000	315,000
Main canals and distribution system	4,900,000	1,400,000
Engineering and contingencies	1,635,000	432,000
Total	$9,809,000	$2,590,000
Cost per acre	$65.40	$51.80

It is possible to serve all of the larger area by a gravity supply from the John Day River and nearly all of the smaller area by a gravity supply contemplating storage on the Umatilla River, though it is certain that both of these projects will be of high initial cost. An investigation and report made by the writer in 1909 indicated a cost of $109 per acre for the John Day development and recent estimates for the Umatilla development indicate a cost of $90 per acre. The proposed pumping schemes, however, must be compared with these possible gravity schemes which latter, despite their high initial cost, may prove the more economical. Until all these alternatives have been developed from careful surveys no final selection of character or size of project is possible. My present opinion, however, is that the pumping schemes will be about on a parity with the gravity schemes, as to ultimate economy, for practically any lift herein considered and in view of their advantage in the matter of requiring a far less initial investment I think they should by all means be included as a possible future demand on Celilo power.

Horse Heaven Slope.—This contemplates the irrigation of 61,000 acres lying on the Washington side of the Columbia River immediately opposite the Castle Rock slope in Oregon. It contemplates a maximum lift of 394 ft. and a mean lift of 300 ft. from a single pumping station located just east of Plymouth, in Sec. 4, T. 5 N., R. 28 E., W. M. There is another feasible pumping station site at Carley, at the extreme westerly end of the project in Sec. 12, T. 4 N., R. 23 E.

If two pumping stations were utilized, the Carley station would serve some 24,000 acres west of Glade Creek and the Plymouth station about 44,000 acres east of Glade Creek, thus embracing a total of about 68,000 acres as against the 61,000 acres contemplated from the single pumping plant at Plymouth. The Carley plant would require about 30 ft. greater lift than the Plymouth plant, and the economy of the two plant arrangement would depend upon the amount that might be saved by reason of the reduced capacities of the main canals, a matter which I have not yet gone into.

There exists some storage possibilities on this project, the reservoir damsites being located in Sec. 21, T. 5 N., R. 24 E.; Sec. 18, T. 5 N., R. 25 E.; and Sec. 21, T. 5 N., R. 25 E. All of these reservoir sites embrace good irrigable lands, and for reasons hereinbefore given storage was not figured on in the preliminary consideration of the project.

The cost estimate for this project, omitting details, is made up as follows:

Pumping station complete	$ 475,000
Pressure mains	80,000
Main canals and distributing system	2,565,000
Engineering and contingencies	624,000
Total	$3,744,000
Cost per acre for 61,000 irrigable acres	$61.38

(To be continued.)

LETTER TO THE EDITOR.

Irrigation Department.

Sir:—I have read with a great deal of interest the announcement in the Journal of the 1st instant, concerning the Irrigation Department, and the article by Professor S. T. Harding who is to have charge of this Department of the Journal. I feel very much pleased myself that you have decided to add this department to the Journal, as I believe it will prove of considerable value to the electrical industry, and will make your journal even more popular than it now is. I would like very much indeed to give this matter considerable personal attention, if you consider it advisable, and to that end shall be glad to advise with Professor Harding at his pleasure.

As you are fully aware the possibilities for the further use of electric energy in the agricultural industry are very extensive. In fact, I feel that we have really just begun to intelligently work in this field. Most of the central stations operating in the Western states already have extensive distributing systems and are so situated that a great deal of additional load in the agricultural communities can be added with a very little increase in investment. This applies particularly to what might be termed the domestic uses of electricity.

Yours very truly, S. M. WALTON,
Manager Commercial Dept., Pacific Gas & Elec. Co.

GRANDVIEW BIDS.

Bids for the power and pumping equipment of the Grandview Irrigation District, Sunnyside Unit, Yakima Project, Wash., have been received at Denver, Colo., as follows:

Schedule 1—Electrical Apparatus.

Name of Bidder.	Item 1. One 187 k.v.a. Gen. & ex.	Item 2. 3-60 k.v.a. Single-phase Transformers.	Item 3. Switch-board Equip-ment.	Combination Bid for all Apparatus in Schedule 1
General Elec. Co., Schenectady, N. Y.	$5,442	$1.472	$3,420	$12,190
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.	2,900	1,230	3,000	1,130
Fairbanks, Morse Co., Denver, Colo.	....	1,482	....	....
Pittsburgh Transformer Co., Pittsburg, Pa.	....	1,152	....	....

Schedule 2—Hydraulic Apparatus.

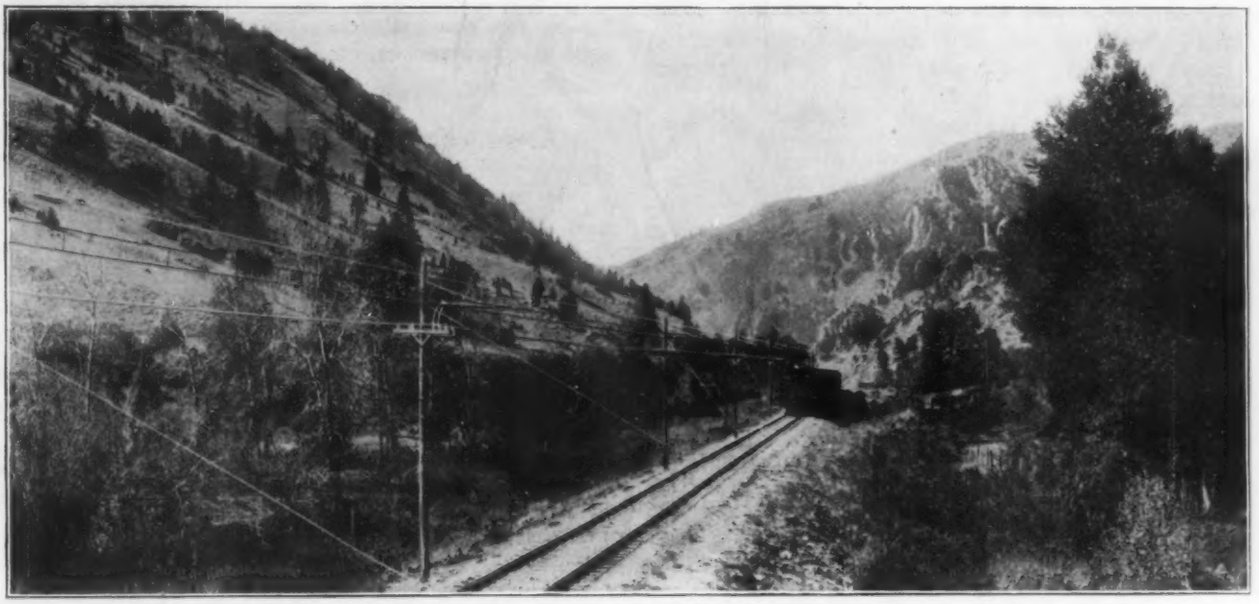
Name of Bidder.	Item 1. Hydraulic Turbine 270 hp., 600 r.p.m. 73 ft. Head.	Item 2. Direct Pumping Unit Using 110 Sec. ft. at 21 ft. Head. Pumping Head 78 ft.	Item 3. 10 Sec. ft. 78 Ft. Lift Pump and Motor.	Item 4. 10 Sec. ft. 35 Ft. Lift Pump and Motor.	Item 5. 10 Ton Hand Power Traveling Crane
S. Morgan Smith Co., York, Pa.	$4,500	$8,300	.....	.....	.....
The Trump Manufacturing Co., Springfield, Ohio.	3,250	.....	.....	.....	.....
Pelton Water Wheel Co.	4,865	.....	Pump	.....	.....
	....	.....	$1.065	$1.065	.....
Pelton Water Wheel Co.	....	.....	G.E. Mot.	.....	.....
	....	.....	$1,088	$1.096	.....
Pelton Water Wheel Co.	....	.....	W.H. Mot.	.....	.....
	....	.....	$ 962	$ 901	.....
Pelton Water Wheel Co.	....	.....	Tot. G.E.	.....	.....
	....	.....	$2,153	$2,161	.....
Pelton Water Wheel Co.	....	.....	Tot. W.H.	.....	.....
	....	.....	$2,027	$1,997	.....
Fairbanks, Morse Co.	....	.....	Pump	.....	.....
	....	.....	$ 635	$ 635	.....
Fairbanks, Morse Co.	....	.....	Total	.....	.....
	....	.....	$1,880	$1,745	.....
Cyclops Iron Wks., Denver	....	.....	.....	.....	$ 675
Whiting Foundry Equip. Co.	....	.....	.....	.....	735
Brown Hoisting Mach. Co.	....	.....	.....	.....	750
Niles-Bement-Pond Co.	....	.....	.....	.....	1,515

Schedule 3—Steel Work, Etc.

Name of Bidder.	Item 1. Riveted Steel Pipes.	Item 2. Cast Iron Head Gates.	Item 3. Trash Racks.	Combination Bid for all Material in Schedule 3.
Western Pipe & Steel Co.	$2,713	$ 525	$ 670	$3,900
Vulcan Iron Works, Denver	.....	420	...	.....
Trump Mfg. Co.	.....	...	510	.....
Judson Mfg. Co., San Francisco	.....	...	397	.....

THE ST. PAUL ELECTRIFICATION.

While many railway terminals and tunnel electrifications have been made in the past, the Chicago, Milwaukee & St. Paul electrification is the first where electric locomotives operate over several engine divisions. Four divisions have been electrified, aggregating 440 miles in length, the first being the Three-Forks-Deer Lodge Division, 115 miles long, and crossing the main Continental Divide. The first electric locomotives were placed in regular service on December 9, 1915, and during the month of April, 1916, service was extended to Harlowton, making a total of 220 miles of electrically operated road. By the first of November, 1916, it is expected that steam engines will be superseded over the entire distance of 440 miles from Harlowton, Montana, to Avery, Idaho, the most extensive steam railway electrification in the world.



"Olympian" Entering the Montana Canyon.

In crossing the three mountain ranges included in the electric zone, there are several grades of one per cent or more, the most difficult of which is the 21 mile two per cent grade between Piedmont and Donald, and the longest the 49 mile one per cent grade on the west slope of the Belt Mountains. The curvature is necessarily heavy, the maximum being 10 degrees. There are also numerous tunnels in the electric zone, 36 in all, of which the longest is the St. Paul Pass tunnel, over a mile and a half in length, through the ridge of the Bitter Root Mountains.

The passenger service consists of two all-steel finely equipped transcontinental trains in each direction, the "Olympian" and "Columbian," and a local passenger train in each direction daily between Deer Lodge and Harlowton.

Freight traffic through the electric zone comprises from four to six trains daily in each direction. Westbound, the tonnage is made up of manufactured products and merchandise for Pacific Coast points and foreign shipments. Eastbound tonnage includes grain, lumber, products of the mines and some live stock.

The Electrical Equipment.

The scheme of electrification includes the generation of electricity from the several water power plants of the Montana Power Company; transmission at 100,000 volts, three-phase, 60 cycles; conversion in substations to 3000 volts direct current and distribution over catenary overhead construction. to electric locomotives. The main line locomotives are constructed in two units permanently coupled together, the halves being duplicates and each capable of independent operation. They are the first to be used for railroad service with direct current motors operating at a potential as high as 3000 volts and the first to use direct current regeneration. The 30 passenger locomotives are equipped with a gear ratio permitting the operation of 800 ton trailing trains at speeds of approximately 60 miles per hour on tangent level track. The average passenger train weighs from 650 to 700 tons and is hauled over the two per cent grade without a helper. The 12 freight locomotives are designed to haul a 2500 ton trailing train at approximately 16 miles per hour on all grades up to and including one per cent. On two per cent grades the trailing load was limited to 1250 tons, although this figure has been exceeded in actual operation.

Each locomotive is equipped with eight Type General Electric 253-A, 1500 volt motors, insulated for 3000 volts to ground. This motor has a normal one hour rating of 430 h.p. and a continuous rating of 375 h.p., so that the locomotive power plant has a normal one hour rating of 3440 h.p. and a continuous rating of 3000 h.p. Each motor is twin geared to its driving axle in the same manner as on the Butte, Anaconda & Pacific, the Detroit River Tunnel, and the Baltimore & Ohio locomotives, a pinion being mounted on each end of the armature shaft. Additional flexibility is obtained by the use of a spring gear and a spring nose suspension which minimize the effect of all shocks and also reduce gear wear to a minimum. The motor

is of the commutating-pole type and is constructed with longitudinal ventilating ducts in the armature for forced ventilation from a blower in the cab.

The control equipment is the Sprague General Electric Type M arranged for multiple unit operation. The main control switches are mounted in steel compartments inside the locomotive cab with convenient aisles for inspection and repairs. A motor generator set in each half of the locomotive furnishes low voltage current for the control circuits, headlights, cab lighting and for charging the storage batteries on the passenger coaches. Under steam operation, the charging current for these batteries is furnished by a steam turbo-generator set located on the locomotive. The blower for ventilating the traction motors is also direct connected to one end of this set.

The pantograph collectors, one of which is mounted on each half of the locomotive, are of the double pan type with a working range of from 17 ft. to 25 ft. above the rail. The contact elements are of the same metal as the trolley wire, so that current passes from copper to copper.

The air brake equipment is practically the same as that used on steam locomotives except that motor driven air compressors are used to furnish compressed air. Aside from the air brakes, compressed air is also used for signals, whistles, bell-ringers, sanders, flange oilers, pantograph trolleys, part of the control equipment, and on the passenger locomotives for the oil-fired steam boilers.

The switching locomotives are of the swivel truck type, weighing 70 tons each, and equipped with four geared motors. A single pantograph of construction similar to that used on the main line locomotives is mounted on the cab and in other ways the locomotives represent the standard construction commonly used with the steeple cab type of switcher. The motors (known as Type GE-255) are of box frame, commutating-pole, single-geared type designed for 1500 volts with an insulation of 3000 volts to the ground. Many of the switching locomotive parts are interchangeable with those used on the main line locomtives; for example, the air compressors, small switches, headlights and cab heaters.

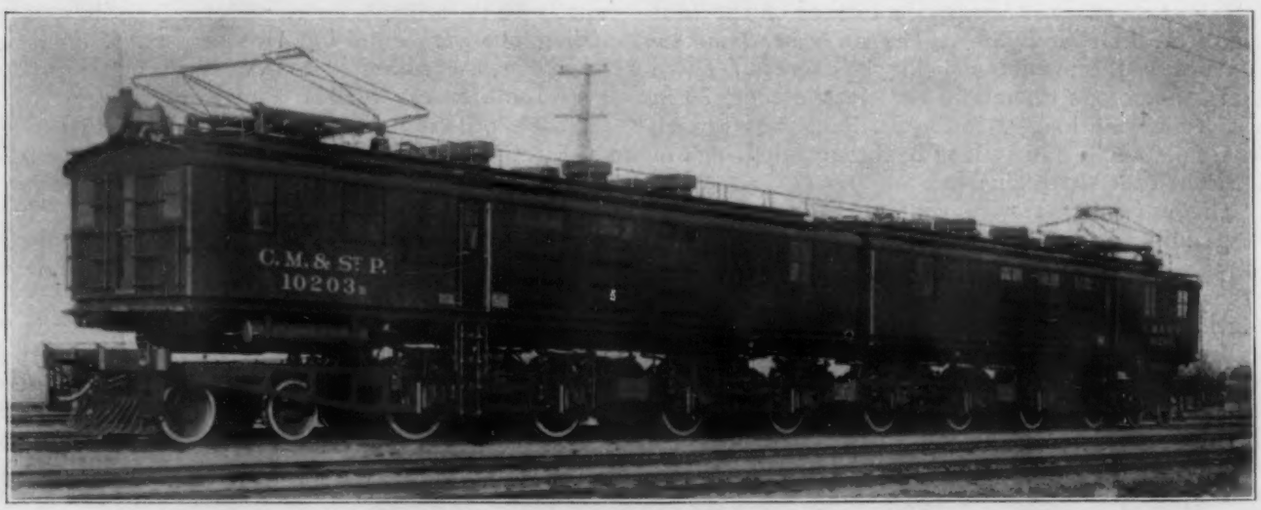
The Montana Power Company's transmission lines, which are carried in some cases on steel towers and in others on wooden poles, tap into the railway system at seven different points where the power is most needed. The railway company's transmission line extends the entire length of the system on wood poles. In most cases this line is built on the company's right-of-way, although at several points there are cutoffs which make a considerable saving in the length of line.

The water power plants are so located at widely separated points that there is little probability of an interruption of the supply. Available capacity of storage reservoirs in service is 447,150 acre feet, of which the largest, the Hebgen reservoir on Madison River, contributes 325,000 acre feet. There is a further undeveloped capacity of 78,500 acre feet.

The standard transmission pole consists of 45 and 50 ft. wood poles with two cross arms carrying 100,000 volt lines on suspension type insulators and also an uninsulated ground wire. There are a number of modifications of this construction on curves, at corner points, substation entrances, etc.

Completed Hydroelectric Plants.	Installed Capacity kw.
Great Falls, on Missouri River	60,000
Rainbow Falls, on Missouri River near Great Falls, completed in 1910	27,000
Black Eagle Falls, on Missouri River near Great Falls, reconstructed in 1913	3,000
Black Eagle Falls, hydraulic power, 8,000 h.p.	
Hauser Lake, on Missouri River, northeast of Helena, completed in 1911	18,000
Canyon Ferry, on Missouri River, northeast of Helena, completed in 1898 and enlarged in 1901	7,500
Madison No. 1, on Madison River, 60 miles southeast of Butte, completed in 1901 and remodelled in 1907	2,000
Madison No. 2, on Madison River, 60 miles southeast of Butte, completed in 1906	10,000
Big Hole, on Big Hole River, 22 miles southwest of Butte, completed in 1898	3,000
Livingston, on Yellowstone River, completed in 1906 and enlarged in 1908	1,500
Billings No. 1, Yellowstone River, completed in 1907	1,080
Lewiston, on Spring Creek, completed in 1906 and remodelled in 1913	450
Thompson Falls, on Clark's Fork of Columbia River	20,000
	153,530
Steam Plants.	
Butte, completed in 1907	5,000
Billings, completed in 1906	560
Conrad, completed in 1910	110
Phoenix, in Butte, completed in 1895	250
	5,920
Total	159,450

Hydroelectric Powers in Course of Development and Definitely Projected.	Capacity kw.
Thompson's Falls, on Clark's Fork of Columbia River, additional units to be installed in 1917	10,000
Holter, on Missouri River near Helena, under construction, to be completed in 1917	40,000
Total	50,000



Electric Locomotives of the Chicago, Milwaukee & St. Paul R. R.

Hydroelectric Power Sites Undeveloped.

Site "C" at Great Falls, on Missouri River, between Rainbow and Great Falls	28,500
Below Great Falls, on Missouri River	28,500
On Missouri River about 30 miles northwest of Missoula	13,500
Madison No. 3, on Madison River	18,500
Black Eagle Plant, reconstruction	10,000
Snake River Falls, on Henry's Fork of Snake River, 20 miles north of St. Anthony, Idaho	22,500
Total	121,500

Summary.

Completed hydroelectric and steam plants	159,450
Hydroelectric powers in course of development	50,000
Hydroelectric power sites undeveloped	121,500
Total	330,950

Summary of Transmission Lines in Service January 1, 1916.

	Miles.
Steel tower lines, 100,000 volts	305
Steel tower lines, 50,000 volts	35
Pole lines, pin type, 11,000 to 60,000 volts	635
Pole lines, suspension insulator type, 50,000 to 100,000	512
Bridge type, 100,000 volts	341
Total	1,828

With this completely inter-connected transmission system, each substation may be fed from either direction and also at the tie-in points from a third source of power.

Fourteen substations are equipped for converting the 100,000 volt alternating current to 3000 volts direct current. They are distributed along the route at average intervals of 32 miles. Each station contains step-down transformers, motor generator sets, switchboard and the necessary controlling and switching equipment. The transformers receive the line current at 100,000 volts and supply the synchronous motors at 2300 volts. Each synchronous motor drives two 1500 volt, direct current generators connected permanently in series, thus supplying 300 volt current for the locomotives. The fields of both the synchronous motors and the direct current generators are separately excited by small direct current generators direct connected to each end of the motor generator shafts.

The overhead construction is of the modified flexible catenary type designed by the General Electric Company and installed under the direction of the railway company's engineers. With this quite novel but remarkably successful construction, the current is collected in both high speed passenger service and heavy freight service without any sparking. As may be seen from the illustrations, the construction comprises two 4/0 copper wires flexibly suspended side by side from the same steel messenger by independent hangers alternately connected to each wire. Bracket construction is used wherever the track alignment will permit, and cross span construction on passing tracks and in the switching yards. All of this work is supported on 40 ft. wooden poles suitably guyed and spaced.

Electrical Operation.

Electrification promises a material reduction in running time. It has been found, for example, that on the 21 mile two per cent grade from Piedmont to Donald, the electric locomotive can reduce the running time of passenger trains from an hour and five minutes to approximately 40 minutes. On the run from Deer Lodge to Butte which, under the steam locomotive schedule, required an hour and 20 minutes, a saving of approximately 30 minutes can be made.

In the freight service, it has been found that on the first division where the steam locomotives have required 10 to 12 hours to make 115 miles, electric locomotives can meet a schedule of from seven to eight hours for the same distance. The heavy grades and frequent curves at certain points offer serious obstacles to steam locomotive operation even in the summer time, but with winter temperatures as low as 40 deg. F. and heavy snowfalls in the Bitter Root Mountains, serious delays have occurred, owing to engine failures or to inability to make steam. The capabilities of the electric locomotives are in no way impaired by cold weather or by inability to obtain fuel or water in case of snow blockades. During a series of record-breaking temperatures in December, 1915, Mallet engines were frozen up at different points on the system and the new electric equipment was rapidly pressed into service to replace them. On several occasions electric locomotives hauled in disabled steam engines and trains which would otherwise have tied up the line.

During initial operation on the Rocky Mountain Division, the capacity of the new locomotives has been thoroughly tested. Trains of 3000 tons trailing have been hauled east and 2800 tons west, using a helper on the heavy grades. From the operating data obtained on the first division, it is evident that much heavier trains can be hauled with the electric locomotives than with steam engines, and all passing tracks are being lengthened to take advantage of longer trains. On some of the runs where the grades are less than one per cent trains of as many as 130 cars and as heavy as 4000 tons have been hauled with a single locomotive.

The four through passenger trains, "Olympian" and "Columbian," are taken across the two mountain ranges by a single passenger locomotive. These trains at present consist of eight full vestibuled steel coaches, weighing approximately 650 tons. Instead of changing locomotives at Three Forks, as has been the practice under steam operation, the same locomotive is run through the 220 miles from Deer Lodge to Harlowton, changing crews midway. Passenger trains will travel over the entire electrified division in approximately 15 hours, including all stops, and the tourist thus will have an opportunity of traversing by daylight some of the most beautiful scenic regions in the United States and without suffering the annoyance of cinders and smoke incident to the use of steam locomotives. The local passenger train operating in the electric zone between Deer Lodge and Harlowton is handled by a half unit weighing about 150 tons with equipment similar to the main line locomotives.

Greater development of water power is urged by the Joint Conference Committee of National Engineering Societies in accordance with the following resolution, copy of which has been transmitted to President Wilson: "The Joint Conference Committee of National Engineering Societies believes that the development of the country's undeveloped water power will increase national prosperity; that private enterprise should be encouraged and stimulated to expedite such development; that unnecessary legal burdens should be removed and existing doubts as to the safety of investment eliminated. It commends to the support of engineers all efforts made to secure the fullest publicity as to the underlying facts regarding this subject."

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Railway Electrification

Electrification of Western steam railways is proceeding apace. The Cascade tunnel of the Great Northern Railway, the ore haulage system of the Butte, Anaconda and Pacific and the Rocky Mountain divisions of the Chicago, Milwaukee and St. Paul, together with the rapid extension of interurban railways, presage a new era of railway operation, when the wasteful fuel-locomotive will be superseded by the efficient electric locomotives.

Yet efficiency may be more costly than waste. So for the present and in most localities, at least, electric operation costs more than steam operation. As cost is necessarily the deciding factor, this means a postponement, but not an abandonment, of many plans for railroad electrification.

In some instances new construction would be electric, though it does not pay to electrify old construction. The interest on bonded indebtedness is of greater concern than the cost of current. In one well known case it has been demonstrated that present conditions do not warrant electrification even if current were furnished free of charge. The reason for high interest charges, is, of course, high initial cost. This in turn is largely traceable to lack of standardization of equipment. Each installation is special and consequently costly.

The St. Paul situation warranted immediate electrification. Coal was expensive and hydroelectric power purchasable at a low price. The Butte, Anaconda and Pacific, operating under somewhat similar conditions, had already effected a saving of one-third in the cost of operation. Electrification was the only answer to the problem of cheaper operation.

But this cost consideration is transient. Railroad electrification is inevitable along all main lines in the West. Railroads have anticipated the fact and paper wars between cost and expediency have been played over many times. Here and there cost is lessened, the defense of this opposition is weakened, and expediency wins a battle.

The day is not far distant when all the transcontinental railways will be electrified throughout this Western territory. This will require a great increase in generating capacity and will mark a resumption of activity in hydroelectric construction.

Industrial Research

The excellent features of Senator Newland's bill proposing to establish industrial research stations in connection with the land-grant colleges in the several states have been previously explained in these columns. No particularly objectionable features have come to light and the bill would be likely to be passed were it not for the apathy of those who have most to gain from its enactment.

This bill is not a scheme to find jobs for dreamers. Its benefits accrue to land grant colleges only because these solely can legally receive federal appropriations at present. As contrasted with any central laboratory it creates many distributed centers for industrial research and will give local industries better opportunity to enlist scientific aid.

Science is anxious to be of greater service to industry. Industry, on the other hand, does not realize science's past contributions to its welfare and consequently cannot appreciate the value of future aid that would result from more scientific research.

The marvellous electrical developments of today would be impossible without knowledge based on the researches of two scientists working with no apparent thought of the utilitarian value of the application of their discoveries. Faraday discovered the fundamental principles of electro-magnetism, upon which depends the operation of all dynamo electric machines. Maxwell codified Faraday's discoveries into a complete theory to guide all future investigators. Without this fundamental knowledge the inventions of Edison, Bell and Marconi would not have been possible.

Many other examples can be cited,—the development of the dye industry by the Germans, the adapting to commercial liquefaction and separation of gases of Thomson and Joule's theory of temperature reduction through the expansion of a gas in a porous plug, or the improvement in the efficiency of incandescent lamps by investigation of the melting points of metals.

This is the day of organized research. Frequently the individual investigator repines at the futility of trying to compete with the trained staffs of big manufacturing companies with every facility at hand. Under a central administrative office individual research could be conducted effectively and thus would the world benefit from work which individuals hesitate to undertake unaided. Any financial encouragement given the research scientist cannot but ultimately redound to the benefit of humanity.

Trade Acceptances

The latest step in the improvement of American business methods is the proposal to more generally employ trade acceptances as credit instruments. While this system has long been used in England under the name of bills of exchange, it is only with the development of the Federal Reserve banks that the need for it has become acute in the United States. The general purpose was explained by Mr. Russell Lowry, president of the First National Bank of Oakland, California, at a recent meeting of the Pacific Coast Electrical Supply Jobbers' Association, and the subject is also being discussed at meetings of the electrical contractors in Washington, Oregon and California. As the trade acceptance seems to offer a means of improving electrical business conditions, a brief discussion seems to be in order here.

The trade acceptance is a negotiable paper accompanying a bill of lading. When a shipment of goods is received, the purchaser writes the word "accepted" across the face of the paper and signs it, thereby converting it into a bill of exchange discountable at the bank, and consequently convertible into cash. By thus doing away with open accounts or ledger entries, the term of credit is shortened to correspond with the saving in time that has been effected by modern transportation methods. Furthermore, the trade acceptance involves less credit risk, as it carries a triple assurance, that of the maker of the instrument, that of the acceptor, and a definite shipment of goods, whose sale will provide a means of payment.

So it is seen virtually to be a safeguarded promise to pay money and serves as a medium of exchange more flexible than barter or cash and involving less risk and loss of time than the usual open account. Not only is it adaptable to business transactions between manufacturer and jobber and between jobber and retailer, but it also seems applicable to dealings between the retailer and the ultimate consumer.

Private credit has been subject to such abuse that its use is being circumscribed. People seem to forget that credit is merely a deferred payment of money and in the end must be liquidated by the payment of cash. Extravagance ensues and the misuse of credit threatens to counteract its usefulness. Trade acceptances can do much to stop such abuses if they are required from the ultimate consumer. They help to weed out the bilks.

The trade acceptance starts an endless chain. It benefits everybody, from the consumer to the banker and back again to the consumer. Like the house that Jack built, this is the trade acceptance that helps the banker that lends to the manufacturer that credits the jobber that carries the dealer that trusts the purchaser who signs a trade acceptance.

A negotiable contract of this kind not only gives evidence of indebtedness, but also provides an acceptable substitute for money. It is a well-known fact that there is nothing like enough money in the world to transact the world's business. So there is always need for a convenient substitute that banks can accept.

From the banker's standpoint the promissory note and ordinary bank check are of limited acceptancy. With the trade acceptance many of these limitations are eliminated. In addition, it is convertible, perhaps the most essential requisite for banking purposes. Lack of convertibility is the reason that commercial banks are limited in their loans on real estate. So highly do bankers regard this plan that the Federal Reserve banks offer a lower rate of discount on trade acceptances than on single-named commercial paper.

From the dealer's standpoint the trade acceptance increases the frequency of capital turnover, and thus allows greater profits on invested capital. Its general adoption would do much to make electrical contracting a profitable business.

The consumer, also, could be assured that he was not paying for the fellow who does not pay his bills. The high cost of living could be partly reduced by this means.

These manifest advantages of trade acceptances are not generally understood. Education is necessary, particularly as regards the public. Every line of business should participate in bringing about this desirable change in order to make it truly effective; but why cannot the electrical industry be the first to study and adopt this commendable plan, thus lifting themselves out of the financial slough?

PERSONALS

C. C. Hillis of the Electric Appliance Company is making a trip to Tahoe by auto.

Romaine W. Myers, illuminating engineer, has returned to Oakland, Cal., from Spokane.

Ralph Clapp, manufacturers' agent, has returned to Los Angeles, from San Francisco.

F. A. Wood, General Pacific Coast agent of the Gamewell Fire Alarm System is at Los Angeles.

W. S. Berry, sales manager Western Electric Company at San Francisco, is away on his vacation.

F. J. Cram of the Electric Appliance Company has returned from his vacation at Monte Rio.

Geo. K. Tackabury, Honolulu representative of the H. W. Johns-Manville Company, is at San Francisco.

Ed. Duggan, with Holabird-Reynolds Company, has returned to San Francisco from his Yosemite trip.

T. H. Nelms addressed the Kilowatt Club of Oakland, Cal., June 29th on how "Electricity Lessens Housework."

T. W. Simpson, Pacific Coast manager Federal Sign System (Electric) at San Francisco, is away on a vacation.

R. H. Coyne, Pacific Coast manager of the Kellogg Switchboard Supply Company, has returned from Los Angeles.

H. R. Noack of Pierson, Roeding & Company, San Francisco is making an extended vacation trip through the mountains.

Clem Copeland has accepted a position in the electrical engineering department of the Los Angeles Aqueduct Power Bureau.

H. A. Sayles, sales manager of the Holabird-Reynolds Company of San Francisco has returned from a two weeks' vacation.

C. M. Swan, general manager acoustical department of the H. W. Johns-Manville Company of New York, is at San Francisco.

R. D. Holabird, president of the Holabird-Reynolds Company of San Francisco, is at his lodge at Lake Tahoe for two weeks.

A. J. Myers, district agent of Wagner Electric & Manufacturing Company, has returned to San Francisco from a two weeks' visit at Los Angeles.

E. B. Strong, Jr., of the Journal of Electricity, Power & Gas, is with Company D, Fifth Regiment, National Guard of California, as commissary sergeant.

M. K. Turner recently resigned from the sales department of the Pacific Light & Power Company of Los Angeles to join the sales force of Smith-Booth-Usher Company of that city.

S. H. Gould, recently with the Municipal Electrical Department of the City of Shanghai, China, has joined the distribution force of the Pacific Light & Power Company of Los Angeles.

A. A. Smith, of the Berkeley Electric Company, Berkeley, Cal., is taking his vacation in Milwaukee, Wis. **J. Fort,** another member of the firm has just returned from the Yosemite Valley, where he spent his vacation.

John A. Britton, vice-president and general manager Pacific Gas & Electric Company, announces that the salaries of the thirty men in his company who have joined the California troop mobilization will be paid until the first of September, at least.

R. F. Hayward, chief engineer and general manager Western Canada Power Company, has been re-elected chairman of the Vancouver, B. C., section of the American Institute of Electrical Engineers, and **H. N. Keifer,** sales engineer Northern Electric Company, secretary.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

The last meeting prior to the summer recess was held on June 28th with a large and enthusiastic attendance. A. E. Drendell, as chairman of the preparedness parade committee, reported that a large electrical section would participate. S. J. Lisberger, as chairman of the day, then introduced W. D'Arcy Ryan, illuminating engineer with the General Electric Company, who gave an interesting talk on "The Development of Illuminating Engineering." After tracing the early history of lighting to the development of the present science of illumination he explained that the latest idea in lighting methods was to obtain artistic effects even at the sacrifice of efficiency—the art of illumination. An interesting feature in this development has been the fact that the original estimate of watts per square foot has been practically constant throughout the period. At first this estimate was too low for effective illumination; then, with greater efficiencies it became correct; later, with still greater efficiencies more light was desired, and finally the desired artistic effect counterbalances the high efficiency of the latest types of lamps. In commenting on the new method of lighting Market street, San Francisco, Mr. Ryan said that it will be the first time that the street will be really seen. He condemned the excess of light as exemplified by the St. Louis scheme and briefly described the proposal to light the retail shopping section of San Francisco.

Los Angeles Jovian Electric League.

The last luncheon of the season, and incidentally, one of the best meetings of the year, was given on June 28th, at Jahnke's Tavern. President Holland presided as usual and the program was provided by Irving R. Solomon, as chairman of the day. Mr. Solomon represents the Gould Storage Battery Company and aside from his technical and commercial ability, is somewhat of an orator. After a few remarks, he introduced Chan Kiu Sing, Secretary of the Chinese Chamber of Commerce, who spoke on "China and America." Mr. Chan's talk was unique and interesting. He stated that the Chinese prefer American-made goods and that the Orient represented a potential market for the trades of the world, and

Oregon Electrical Contractors and

that with her population of 420 millions, China presented untold opportunities to the business interests of this country. He was followed by Joe Scott, who roused his hearers to a high pitch of enthusiasm and emotion in an intensely interesting and inspiring address on "America." He was greeted with prolonged applause at the close of his speech. During the business session preceding the talks, it was announced that J. G. Pomeroy had been appointed to represent the League at the Jovian Convention to be held at Indianapolis, in October. Preliminary arrangements for the Rejuvenation to be held on Jovian Day, September 19th, were made and Harry Sessions was appointed chairman of the general committee.

Oregon Electrical Contractors.

The first quarterly convention of the Oregon Association of Electrical Contractors and Dealers was held at Portland, Oregon, on Wednesday, June 28, 1916, the program for the day consisted of meeting out of town members at the office of the secretary during the morning, and at 12:30, all members and their guests met at the Stubbs Electric Company, where a photo was taken, after which all were assigned to automobiles and taken for a drive over the Columbia River Highway as far as Cascade Locks, making stops at nearly all of the places of interest en route. At 5:30 p. m. all assembled at the Crown Point Chalet, the highest point on the highway and at 6 o'clock partook of a banquet furnished by Mrs. Henderson, which has now become famous. During the dinner the Oregon Electric Quartet rendered several fine selections, and the contractors pride themselves upon having the best quartet in the Northwest. They are Ed. Pierce, R. G. Littler, E. L. Knight and Frank Pierce. At 7:30 p. m. the meeting was called to order by President W. O. Foucks who made a report on the progress of the association since its inception, February 9, 1916, and reported that starting with twelve members at that time the association after four months' time had increased its membership to 59 regular and three associate members. Short addresses were given by F. N. Averill of the Fobes Supply Company, upon "Trade Acceptances," Ross Hartley of the Pacific States Electric on "Relations Between the Jobber and the Dealer," J. C. English, "What the Association had Accomplished." Mr. Dickenson of the General Electric Company's Illuminating Engineering Department gave a short history on illuminating appliances, Mr. Colwell of the Western Electric Company addressed the association and complimented them for the fine progress it was making. Messrs. Meecham and NePage of the Washington Association of Electrical Contractors and Dealers were present and each made a fine and interesting talk on association affairs. There were also short talks from John L. Vaughan of Pendleton, Mr. W. H. Welch of Salem, Mr. Chaphe of Tillamook and Mr. Walrath of Forest Grove.

AMERICA'S ELECTRICAL WEEK COMMITTEEMEN.

The following have been named as California Committeemen for "America's Electrical Week," to be conducted by the Society for Electrical Development, December 2-9, 1916:

Fresno—A. G. Wishon, General Manager San Joaquin Light & Power Corporation.

Los Angeles—H. B. Woodhill, general manager Woodhill & Hulse Electric Company; T. E. Burger, manager Western Electric Company; J. O. Case, General Electric Company; J. Harry Pieper, Southern California Edison Company; J. C. Rendler, president Southern California Electric Company; E. R. Davis, general manager Pacific Light & Power Company; K. E. Van Kuran, district manager, Westinghouse Electric & Manufacturing Company; Carl E. Johnson, general manager U. S. Electrical Manufacturing Company; F. H. Trimble, Electric Lighting Supply Company; N. W. Graham, Holabird-Reynolds Electric Company; C. E. Spalding, Edison Lamp Works General Electric Company; H. C. Warden, secretary The Rotary Club; Morris M. Rathbun, Chamber of Commerce.

Oakland—F. H. Woodward, manager Great Western Power Company; E. C. Wilson, Great Western Power Company; J. H. Brown, traffic manager San Francisco-Oakland Terminal Railways; H. W. Kimball, Kimball Electric Company; Chamber of Commerce, Commercial Club.

Sacramento—C. W. McKillip, district manager Pacific Gas & Electric Company; B. E. Hannon, district manager Great Western Power Company; J. G. Hobrecht, 1014 Sixth street.

San Diego—H. H. Jones, president San Diego Consolidated Gas & Electric Company; A. E. Holloway, contract agent San Diego Consolidated Gas & Electric Company; W. Tomkins, assistant secretary Chamber of Commerce.

San Francisco—John A. Britton, vice-president and general manager Pacific Gas & Electric Company; J. W. Redpath, secretary California Electrical Contractors' Association; Carl E. Heise, district manager Westinghouse Electric & Manufacturing Company; F. H. Leggett, manager Western Electric Company; W. W. Briggs, general agent Great Western Power Company; Dr. Thomas Addison, Pacific Coast Manager General Electric Company; C. L. Chamblin, California Electric Construction Company; T. E. Bibbins, local manager General Electric Company; E. B. Strong, Journal of Electricity, Power & Gas; H. V. Carter, Pacific States Electric Company; R. M. Alvord, General Electric Company; Robert N. Lynch, vice-president and manager Chamber of Commerce.

San Jose—J. D. Kuster, district manager Pacific Gas & Electric Company; Dan Coyle, 528 South Second street; Frank J. Somers, 38 S. San Antonio, Chamber of Commerce.

Santa Barbara—R. H. Sterling, manager Santa Barbara Gas & Electric Company; J. S. Reynolds, Reynolds Electric Supply Company.

Stockton—Samuel Kahn, manager Western States Gas & Electric Company; H. H. Adams, manager Oro Electric Company; L. G. Youdall.

Arizona.

H. L. Aller, manager Pacific Gas & Electric Company, Phoenix, Ariz., and Frank E. Russell, manager Tucson Gas & Electric Company, have been named as Arizona committeemen.

Dealers at Portland, June 28, 1916.

Utah.

S. R. Inch, operating manager Utah Power & Light Company; A. R. Loughborough, manager Western Electric Company; W. Scott, president Electric Club; R. W. Nichol, president Capitol Electric Company; R. J. Dunwoody, sales manager Inter-Mountain Electric Company; John C. Jones, manager Westinghouse Electric & Manufacturing Company; E. H. Eardley, Eardley Bros. Co.; W. R. Putnam, sales manager Utah Power & Light Company; H. D. Randall, manager General Electric Company; H. D. Howell, district manager Westinghouse Lamp Company, and S. H. Clay, secretary Commercial Club, all of Salt Lake City, have been named as Utah committeemen.

Oregon.

Franklin T. Griffith, president Portland Railway, Light & Power Company; J. A. Cranston, manager General Electric Company; J. R. Tomlinson, Pierce-Tomlinson Electric Company; O. B. Coldwell, general superintendent Portland Railway, Light & Power Company; J. Ryan, manager Western Electric Company; H. S. Wells, Pacific Power & Light Company; A. C. McMicken, sales manager Portland Railway, Light & Power Company; George G. Bowne, assistant sales manager Northwestern Electric Company; C. L. Wernicke, manager Westinghouse Electric & Manufacturing Company; F. C. Green, E. L. Knight & Company, and C. M. Will, Fobes Supply Company, all of Portland have been named as Oregon's committeemen.

Washington.

Aberdeen—P. A. Bertrand, manager Grays Harbor Railway & Light Company.

North Yakima—Geo. C. Sawyer, local manager, Pacific Power & Light Company; W. B. Hillman, Hillman Electric Company.

Seattle—A. W. Leonard, President Puget Sound Traction, Light & Power Company; H. J. Gille, sales manager Puget Sound Traction, Light & Power Company; Harry Byrne, North Coast Electric Company; R. G. Logan, Consumers' Gas Appliance Company; W. H. Byers, president State of Washington Electric Contractors and Dealers, NePage, McKenny & Company; J. I. Colwell, manager Western Electric Company; George R. Cooley, Buxbaum & Cooley; C. P. Stevens, Westinghouse Lamp Company; J. J. Agutter, president J. J. Agutter Company; Chamber of Commerce.

Spokane—D. L. Huntington, President Washington Water Power Company; M. C. Osborn, commercial agent, Washington Water Power Company; H. L. Bargion, Washington Electric Supply Company; E. A. H. Stevenson; Lewis A. Lewis, assistant commercial agent, Washington Water Power Company, Chamber of Commerce.

Tacoma—L. H. Bean, manager Tacoma Railway & Power Company; Geo. W. Rounds, general superintendent Tacoma Railway & Power Company; Wm. S. Anderson, Home Electric Company; A. F. Douglas, H. M. Byllesby & Company; J. G. Parkhurst, general manager Tacoma Electric Fixture Supply Company; Wm. A. Mullins, W. A. Mullins Electric Company; Commercial Club, Chamber of Commerce.

Walla Walla—C. S. Walters, manager Pacific Power & Light Company; L. C. Sutherland, Electric Supply & Fixture Company.

Montana.

J. F. Roche, general manager Montana Power Company at Billings; F. M. Kerr, general superintendent Montana Power Company; Jacob Duhan, Montana Electric Company; Chas. Austin, secretary Chamber of Commerce of Butte; W. C. Callaghan, general manager Helena Light & Railway Company; W. B. MacDonald, Northern Idaho & Montana Power Company, and A. J. Mosby, Northwestern Electric & Supply Company, at Kalispell; C. H. Christensen, manager Missoula Light & Water Company, have been named as Montana committeemen.

Idaho.

W. T. Wallace, Electric Investment Company; O. G. F. Markhus, general manager Idaho Railway, Light & Power Company; H. D. Pope, Pope Electric Company, Commercial Club of Boise have been named as Idaho committeemen.

Nevada.

T. B. Mechling, district manager The Nevada-California Power Company at Goldfield; Geo. A. Campbell, general manager Truckee River General Electric Company, and F. V. McAvoy, president and general manager Reno Electric Works, at Reno, have been named as Nevada committeemen.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

The commission has authorized the Oakland, Antioch & Eastern Railway to issue two promissory notes, one for $15,000 and the other for $10,000 to the First National Bank of Oakland, interest at six per cent, and maturing not later than June 30, 1917. The company is permitted to pledge $42,000 of its bonds and securities for these notes, which are to reduce similar notes outstanding.

The commission has approved a trust deed submitted by the Corona Gas & Electric Light Company, under which the company will issue first mortgage six per cent fifty year bonds.

NEWS OF OREGON PUBLIC SERVICE COMMISSION.

The commission has issued a general order pertaining to vertical and horizontal clearances upon all railroads and street railways within the state.

NEWS OF IDAHO PUBLIC UTILITIES COMMISSION.

The Utah Power & Light Company has been granted a certificate of public convenience and necessity at Downey, Bannock County, Idaho, thus confirming a franchise granted March 7, 1913, before the public utilities act became effective.

SUGGESTIONS FOR ELECTRICAL DEALERS.

At a meeting of the Retail Section of the Contractors' and Dealers' Association of San Francisco it was suggested that a list of items sold be listed, so as to see the proportion of appliances sold by the retailers. It was also discussed at the meeting the advisability of starting a campaign of education, so that the people will do their buying in retail shops instead of department stores and hardware shops. The idea was that each one participating will agree to contrubute a certain amount for about six months.

TRADE NOTES.

Kelman Electric & Mfg. Company of Los Angeles have closed up the Electric Washing Machine department of their business, having sold their electric washer patents, business and good will to the P. A. Geier Company of Cleveland, Ohio, who are preparing to manufacture the electric washer in large quantities and to conduct an aggressive sales campaign all over the country. Kelman Electric & Manufacturing Company will continue the manufacture of high voltage switches and circuit breakers.

A motion picture devoted to the electric washing machine and iron has made its appearance under the attractive title "The Education of Mrs. Drudge." This film devotes its 1000 ft. to show how a woman shackled to the old fashioned wash tub is emancipated and made happy by the purchase of an electric washing machine and iron. It's advertising of course, but advertising that is subordinated to human interest; and it thereby gets across its double message. The picture has been produced by the Western Electric Company and is furnished to central stations and electrical dealers to further their sales of the commodities. Western Electric offices are booking them for advance production.

NEWS NOTES

INCORPORATIONS.

SPOKANE, WASH.—Sumpter Power & Water Company, $100,000, by R. E. Strahorn, W. E. Weed.

BEAVER, UTAH.—The Manderfield Irrigation & Reservoir Company has been incorporated here.

SAN FRANCISCO, CAL.—McFell Electric Company, $10,000, shares $10 each, subscribed $9000, by F. W. Watts 859 shares, Grace Watts 40 and J. W. Henderson 1.

RENO, CAL.—Articles of incorporation have been filed with the county clerk by the Eagle and Honey Lakes Exploration Syndicate, capitalized at $50,000 with 50,000 shares at $1 each. The principal office of the company is located in Reno, but the articles provide that an office may be established in Lassen county, Cal. The incorporators are D. S. Dickerson, Carl J. Young, and E. M. Young. This corporation will take over the reservoir site and water rights of Carl J. Young situated in Lassen county, for the purpose of disposing of them to the settlers.

ILLUMINATION.

SANTA ROSA, CAL.—The Wilson Lighting District will be organized as the result of a recent election.

BANNING, CAL.—A movement is on foot here for the city to purchase the lighting plant of the Banning Gas & Lighting Company.

NOVATO, CAL.—The Novato Utilities Company has been granted a 25 year franchise to operate an electric light and power service in this district.

SAN LEANDRO, CAL.—Mayor Allen E. Pelton and the trustees have inaugurated a campaign for the installation of electroliers along East Fourteenth street.

LOS ANGELES, CAL.—The contract for improvement work in the Graham Lighting District has been awarded to the Southern California Edison Company.

LOS ANGELES, CAL.—Sealed bids will be received by the board of supervisors up to July 24th for furnishing lighting fixtures for the hall of records, in accordance with plans and specifications on file with the board.

TUSTIN, CAL.—The bid of the Southern California Edison Company for furnishing lights for the Tustin lighting district at $1.15 per 32 c.p. tungsten lamp per month, has been accepted by the board of supervisors.

SAN MATEO, CAL.—Hayward Park boosters have launched a movement for the installation of electroliers in the district bounded by Ninth and Sixteenth avenues and El Camino Real. A petition has been presentel to the San Mateo trustees.

LOS ANGELES, CAL.—A petition has been received by the city council from E. O. Engstrum, et al., asking that centrifugally made concrete lighting standards be used in the ornamental lighting system proposed for Washington street from Main to Vermont.

EL PASO, TEX.—The Rotary Club lighting committee is making plans for having a number of the downtown streets illuminated with electric arcs. Streets being considered for the new lighting are San Antonio, Oregon, Mesa avenue, Stanton, Mills and Texas.

TRANSMISSION.

PORTERVILLE, CAL.—Construction crews from the Mt. Whitney Power Company have started work on new service lines to the Doyle Colony, where a number of new places are being developed.

SPOKANE, WASH.—Porter Brothers of Spokane have been awarded the contract for building a steam heating and electric power plant for the Spokane Heat, Light & Power Company at $88,000, by E. Darrow, manager.

SOUTH BEND, WASH.—The next move on the part of the Willapa Power Company will be the construction of a dam on the South Fork. Manager Nettleton says that the dam will be of fir timbers, and 24 ft. high. There will be a pipe line about 700 ft. long from the dam to the power plant.

SEASIDE, ORE.—The council has passed an ordinance which extends for a period of 25 years the franchise held by the Pacific Light & Power Company. Floyd J. Keys, manager of the company's interests in Seaside stated that the erection of a high tension power line from Astoria to Seaside will commence at once.

EL PASO, TEXAS.—All overhead electric and power wires in the business district are to be placed underground in conduits at a total cost of $325,000. Work will be started as soon as materials can be assembled which will probably be within 90 days. Stone & Webster are owners of the street railway and lighting properties of El Paso.

PRESTON, IDAHO.—The gigantic power project of the Utah Power & Light Company at Grace, Idaho, promises to be the largest one installed in the intermountain country. Two million ft. of lumber will be put into flumes, 100 carloads of cement will be used in dams, etc., and 800 tons of reinforced steel will be used. The canal at Bear Lake will be widened to 60 ft.

JOHN DAY, ORE.—Transmission of electric power over the new lines of the Prairie Power Company has commenced. So far, power is only being delivered to the gold dredge, but it is intended soon to furnish John Day and Canyon City with lights and power from the same source. The extensions and improvements made by the Prairie Power Company in the past year have involved the expenditure of nearly $50,000.

PRESCOTT, ARIZ.—Immediate construction of a plant by the Arizona Hydraulic Power Company undertaking to generate electricity by water storage, is assured, it is stated by E. H. Meek. The plan is to generate electrical power for copper camps of Gila county. Surveys have been run from Verde River. The length of the transmission line will be about 70 miles. It is probable that active construction work will begin within 60 days.

TELEPHONE AND TELEGRAPH.

GILROY, CAL.—The Gilroy Investment Company has let the contract for the erection of a telephone building to cost $6760.

SAN FRANCISCO, CAL.—An ordinance has been passed granting permission to the U. S. Government to lay conduits in the streets of this city for operating telephone service and other governmental uses.

PETALUMA, CAL.—At the annual meeting of the Petaluma Telephone Company, the following directors were elected: D. W. Long, D. M. Winans, S. L. Stice, E. P. Nisson, T. G. King, C. P. Christiansen, J. J. Bergstedt, G. W. Gaston, John R. Denman. The members decided to increase the telephone rates from $10.50 to $12 per year.

DOUGLAS, ARIZ.—Improved Western Union service in Douglas, as well as other Arizona towns is promised as the result of a visit from Hugh McPhee, district superintendent of the company. A new quadruplex instrument will be installed in the office here and a generator will take the place of gravity batteries now in use. A new line from Nogales to Tucson has been authorized also.

TRANSPORTATION.

DUNCAN, ARIZ.—The Carlisle Mining Company is planning the erection of a modern electrical power plant at Duncan and an electric railway, between Duncan and the mines at Steeplerock, N. M.

SANTA ANA, CAL.—The Pacific Electric Railway Company and its assigns have been granted the right to construct and operate a standard gauge double track curve connection between its double track railroad on Fourth street and its double track on Main street.

SANTA ANA, CAL.—It is stated that the Pacific Electric Company will lower its grade through the Garden Grove section for a length of track of 2800 ft. The track will be lowered 3 ft., 4 inches, leaving the same only 20 inches above the general grade of the land. Culverts will be placed where needed.

IRRIGATION.

KALISPELL, MONT.—J. A. Green, general manager of the North Idaho and Montana Power Company, is considering the construction of a power pumping scheme here.

RED BLUFF, CAL.—A project has been launched involving the irrigation of all Antelope Valley, about 5000 acres. It is proposed to install a big pumping station in the Sacramento River.

MONTAGUE, CAL.—A. L. Harlow has purchased 1800 additional acres of land in the vicinity of Grenada. His holdings now in that vicinity are about 5000 acres and he intends to put the entire tract under water and subdivide it into small tracts.

STOCKTON, CAL.—Engineer Walter G. Hunter has estimated that it will cost $285,000 to carry out the plans of the West Side Irrigation District which proposes to water a section in the vicinity of Tracy from the Old River, a branch of the San Joaquin River. A bond issue of $295,000 will be voted on.

SACRAMENTO, CAL.—By voting $90,000 worth of bonds at a special election, the residents of the Carmichael colonies, a tract east of this city, have assured the first irrigation district under the Wright act in the Sacramento Valley. There were 41 votes in favor of bonding the district for $90,000, and only five voted against the proposition.

RENO, NEV.—Water sufficient to irrigate from 25,000 to 30,000 acres of land will be conserved by the new irrigation dam which will probably be erected this year on the Truckee River in the Pyramid Lake Indian reservation. The sum of $85,000 was appropriated by the present Congress for irrigation on the Pyramid reservation. Of this sum $30,000 was set aside for a concrete dam across the Truckee, and the remaining $55,000 is to be used in the construction of ditches and flumes.

VINA, CAL.—Three huge trestles are being constructed by the Stanford Vina ranch for carrying corrugated iron flumes across canyons to connect sections of the $35,000 irrigation ditch, recently completed by the Chico Construction Company for the Stanford ranch. The trestles are about 30 ft. high at their highest point and are to cost approximately $10,000. Water will be carried from the new dam on Deer Creek through this ditch, to a tract of bottom land about three miles north, and used for irrigation.

SACRAMENTO, CAL.—An irrigation system to supply water to land in eastern and central Solano county and to orchards in Suisun Valley is proposed by men financially interested in Solano. The system is to cover 20,000 acres to 30,000 acres. Tentative plans call for the taking of water from the Sacramento River through one of the sloughs or dredge canals, probably on the west Sacramento project in Yolo County, opposite Sacramento. Pumps would be used to lift the water into a higher canal that would convey it to the district to be watered.

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WARD LEONARD

90,000 ohms.

One single layer of wire on a porcelain tube 8½" long by 1½" in diameter.

Possible Because

This wire, and the joints between this wire and the terminal leads are completely covered by a thin layer of vitreous enamel.

This enamel

gives protection against electrical, mechanical and chemical depreciation of the wire. The atmosphere cannot reach the wires.

Its meaning to you:—

with our unit you will replace any units you now use and save space—money—and annoyance.

Tell us your requirements. We can be of service to you.

Ward Leonard Electric Co.
Mt. Vernon, N. Y.